



Armed Forces College of Medicine AFCM



Anti-Arrhythmic Drugs

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Intended Learning Objectives (ILOs)

1. Classify the **classes** of anti-arrhythmic drugs
2. Explain the **mechanisms** of action and **adverse** effects of the anti-arrhythmic drugs
3. Identify the **choice** of the anti-arrhythmic drugs in the most common types of arrhythmias.



Arrhythmia

- Arrhythmia means any abnormality in:

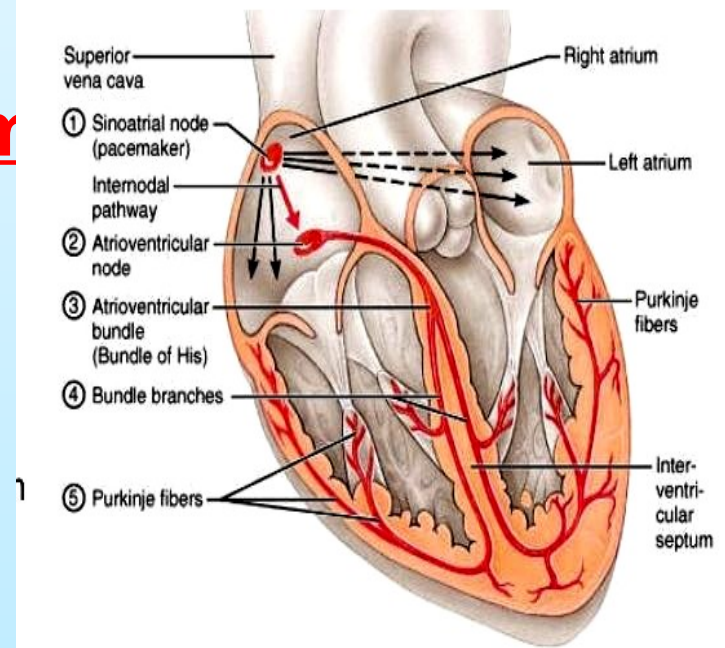
- Rate.
- Regularity.



Dysrhythmia (Arrhythmia)

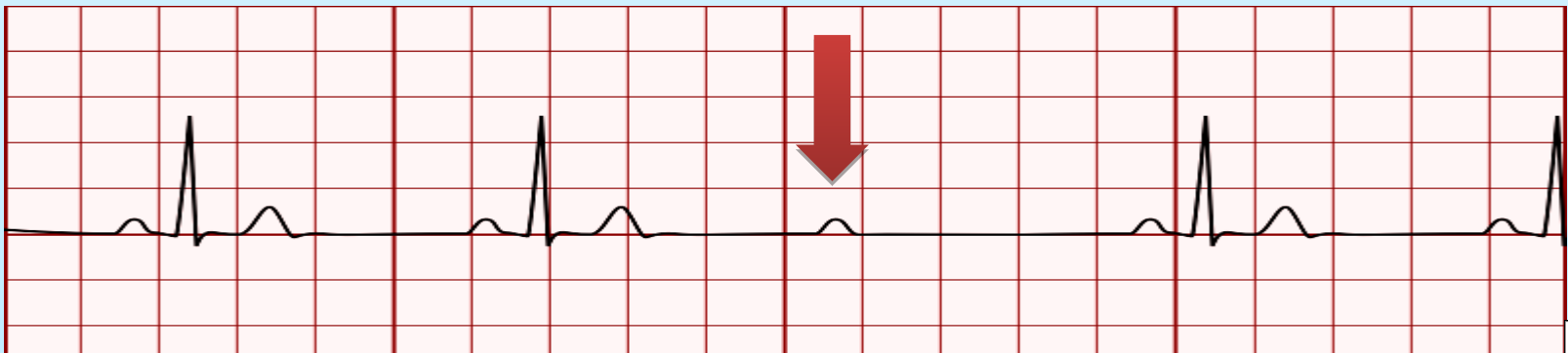
- **Dysrhythmia** (Arrhythmia) means any abnormality in: Conducting System

- **Origin.**
- **Conduction of an Im**



Types of Dysrhythmia

1- S.A.N.: Sinus Tachycardia or
Bradycardia



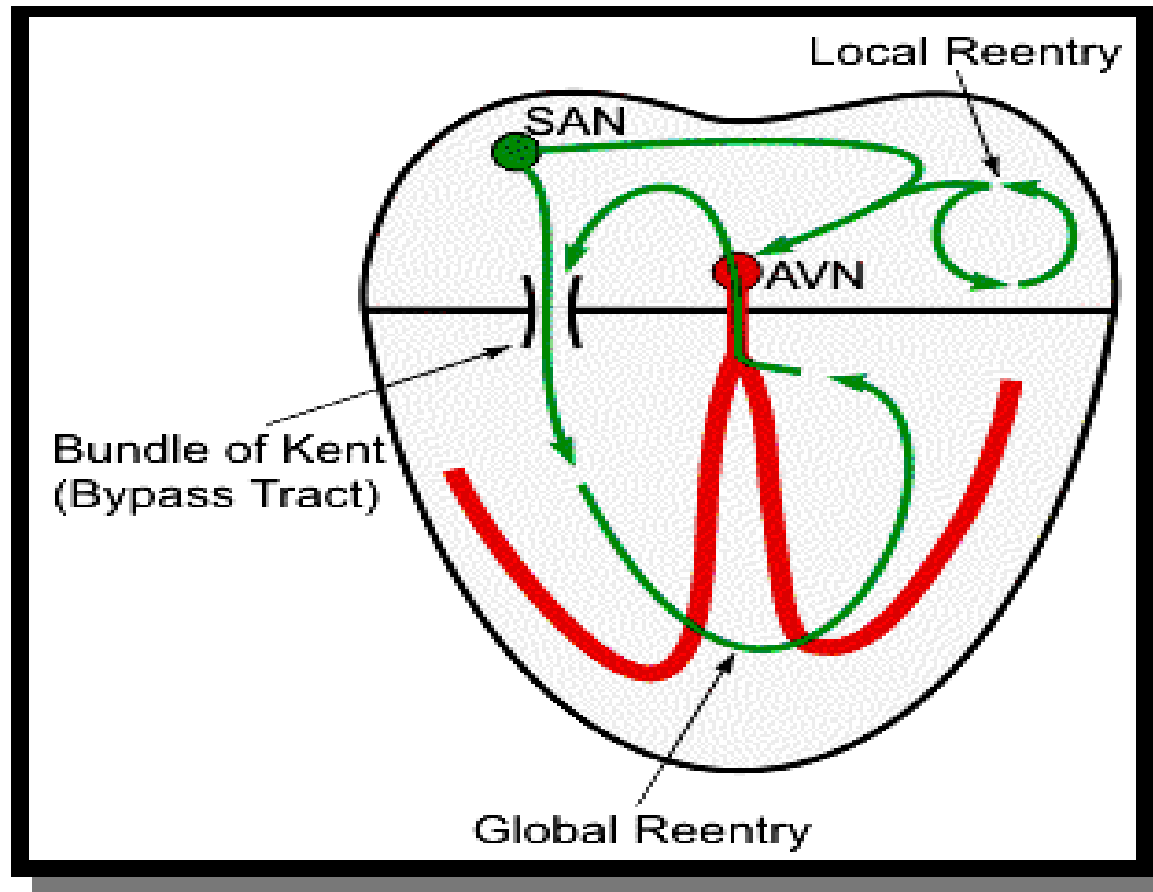
Types of Dysrhythmia

3- Single Ectopic Focus (E.F.): Extrasystoles

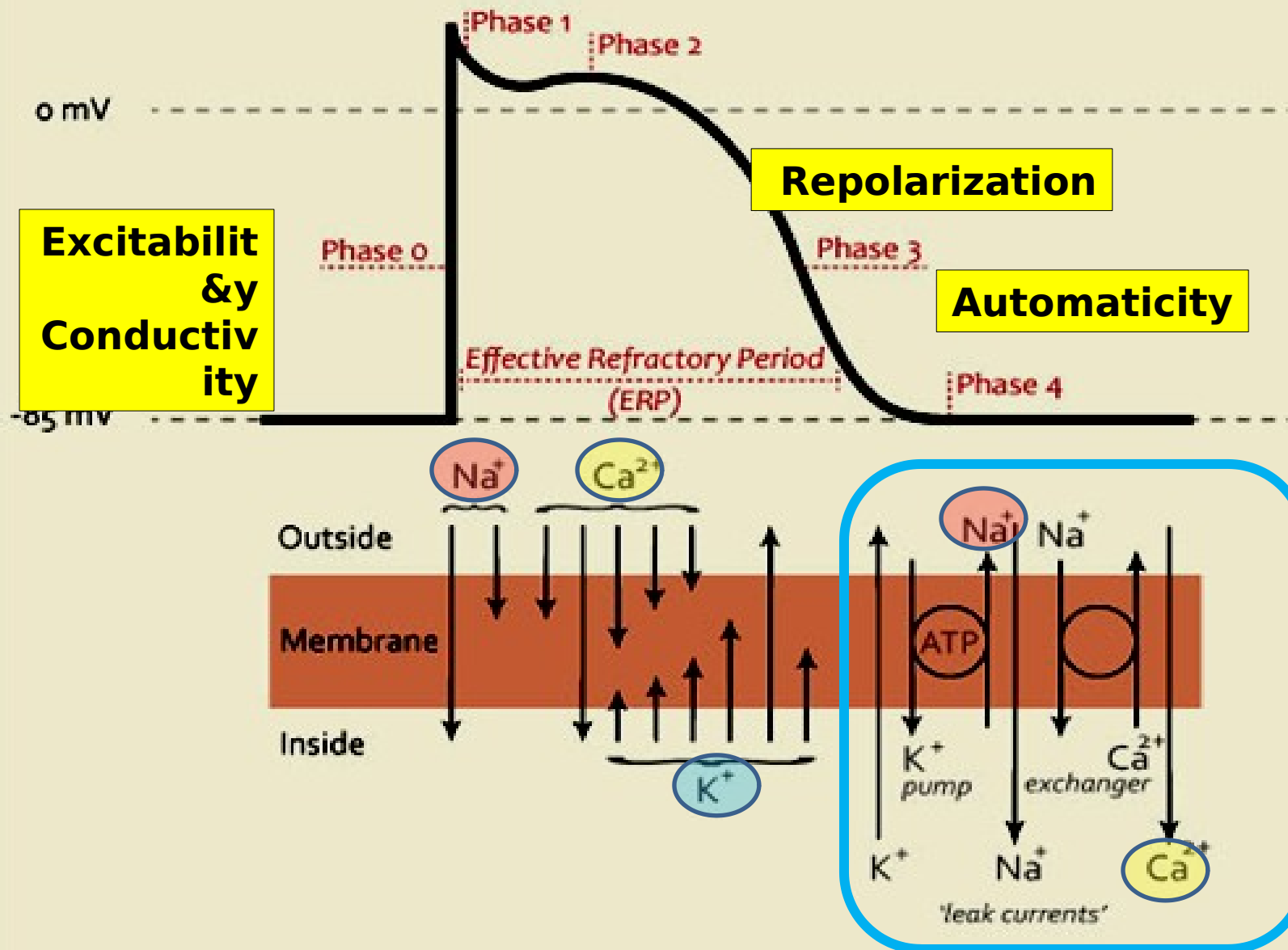
Ventricular Extrasystole



Re-Enterant Circus Movement



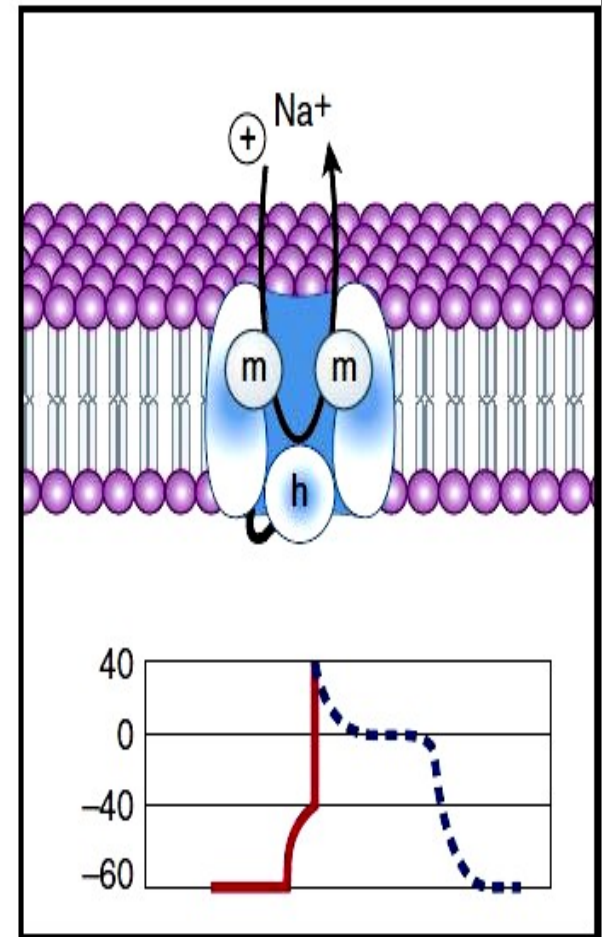
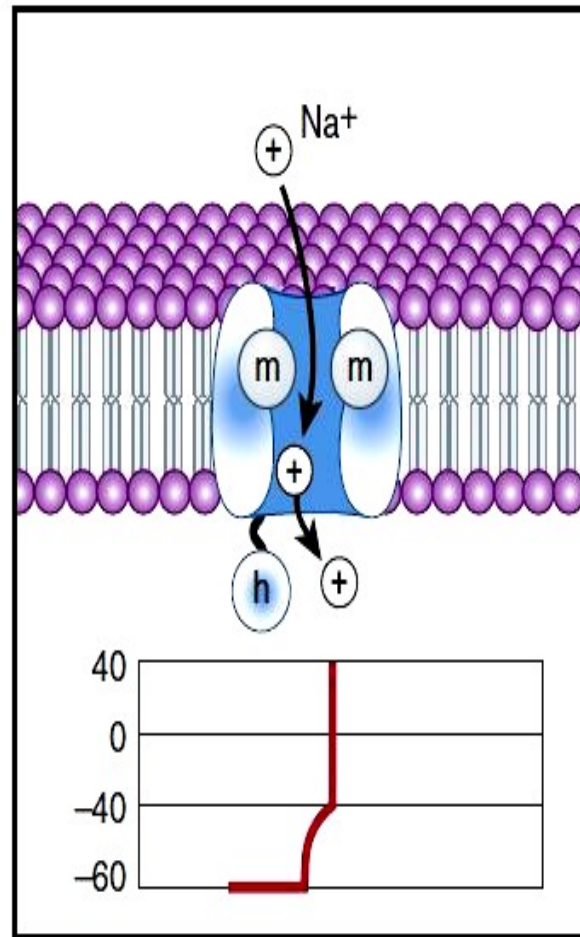
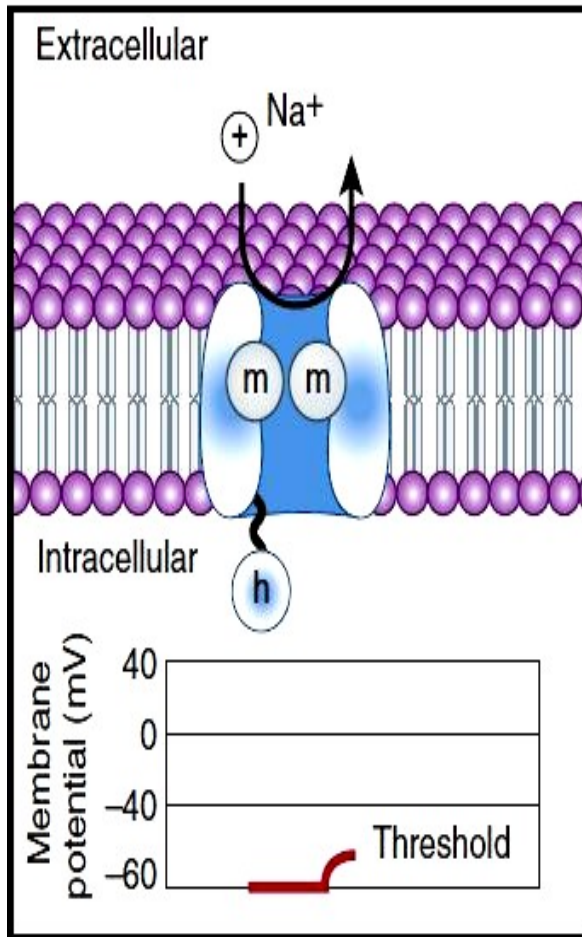
Ventricular Action Potential



Resting

Activated

Inactivated



Recovery



Anti-Arrhythmic Drugs

I- **Class I:** Na^+ Channel blockers =
Membrane Stabilizers

<u>Group A</u>	<u>Group B</u>	<u>Group C</u>
✓ Activated Na^+ channel ✓ Inactivated Na^+ Channel ✓ K^+ Channel	<u>Mainly</u> <u>In</u>activated Na^+ Channel	<u>Mainly</u> Activated Na^+ Channels
Quinidine Disopyramide Procainamide	<u>May</u> <u>± Activate K^+ Channel</u> Lidocaine	Propafenone, Flecainide & Encainone



2) **Class II:** β -Blockers e.g. **Propranolol** & **Atenolol**

3) **Class III:**

Block **MAINLY K⁺ Channels** → Long Phase -1
(3) Delay **Repolarization** → → Long **APR** & **ERP**

Examples: **Amiodarone**, **Bretylium**, -2
Sotalol & **Oxyfedrine**

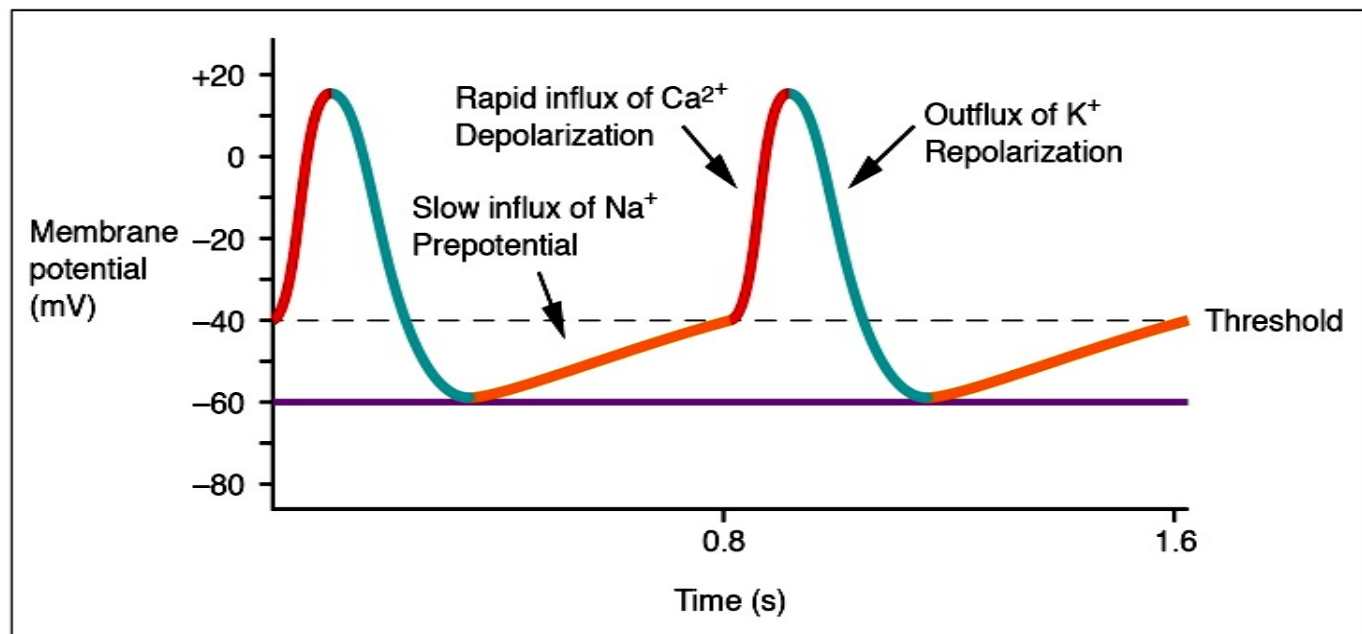


4) Class IV:

- 1- Block Voltage-dependent L-type of Ca^{2+} channels
- 2- Normal muscle fiber → **Short Phase (2)**

S.A.N. & A.V.N. → Slow **Excitability** & **Conductivity**

3- **Excitability**



4) Class IV:

5- Examples: Calcium Channel Blockers (CCB) e.g. **Verapamil** & **Diltiazem**.



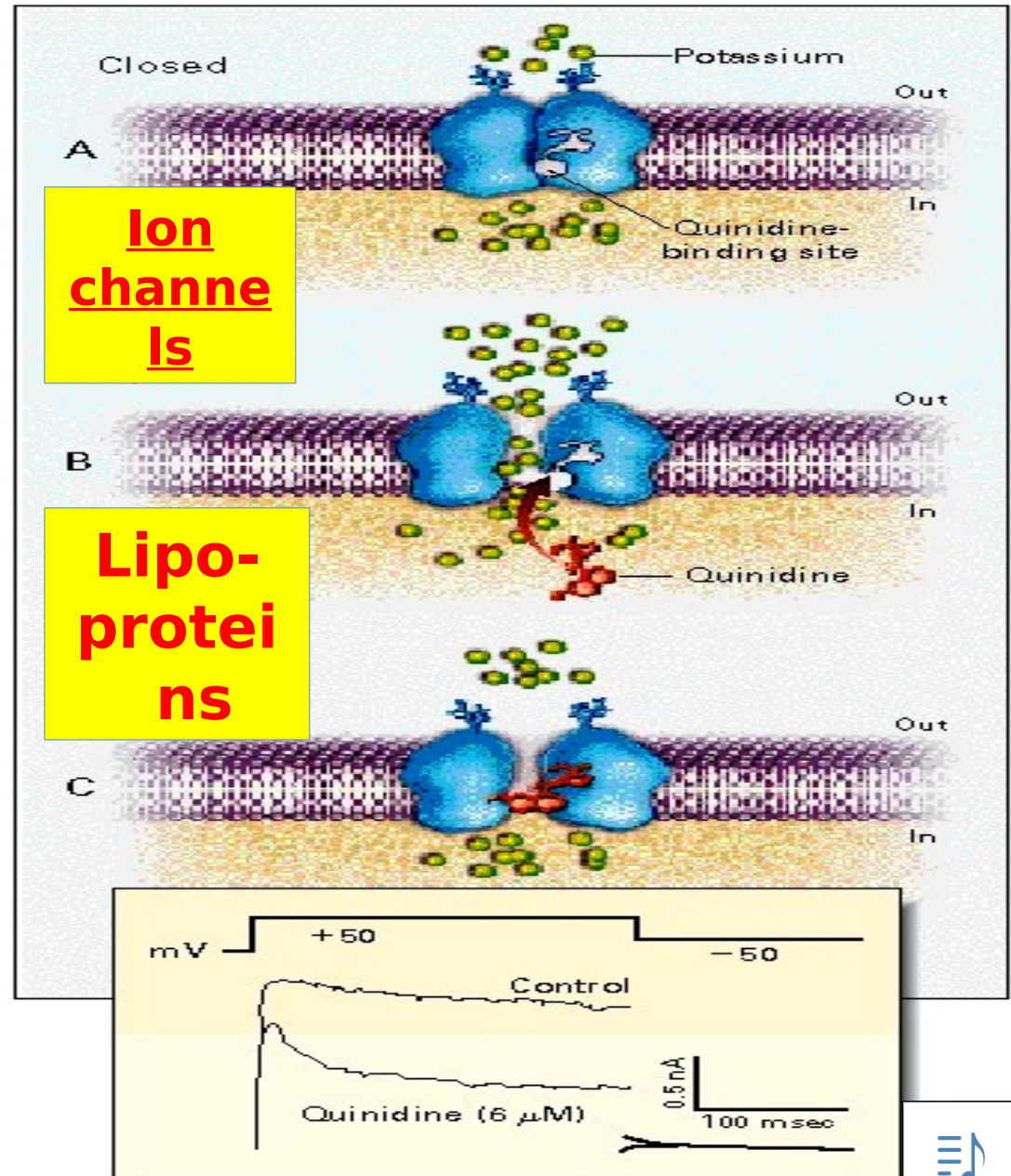
Quinidine

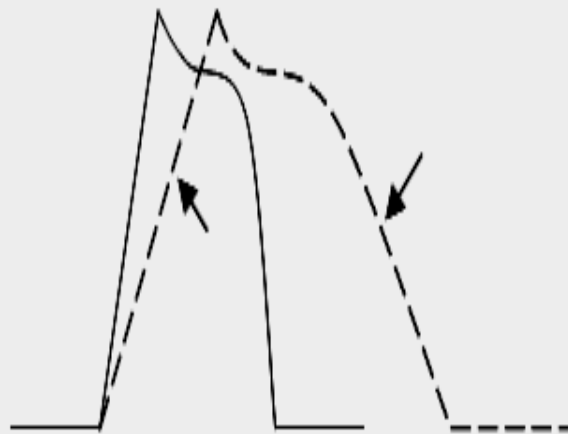
block

✓ Activated Na^+ channel

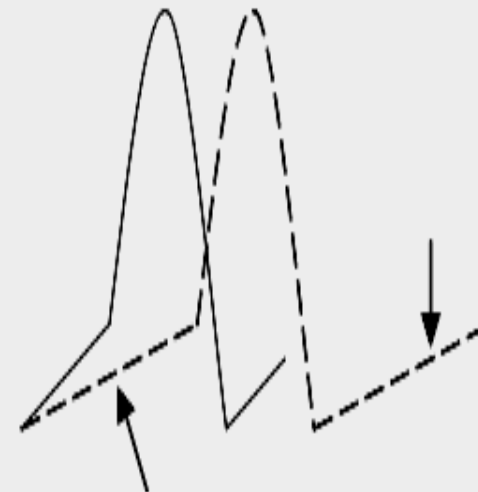
✓ Inactivate Na^+ Channel

✓ K $^+$ Channel

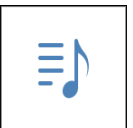




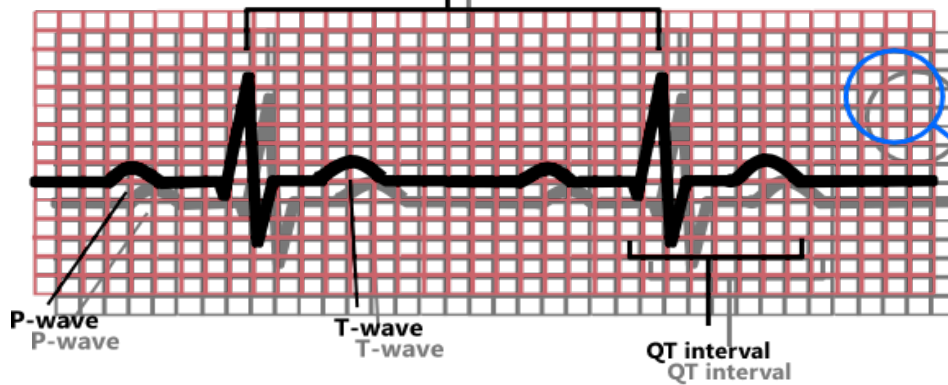
— Normal Cardiac muscle
 ---- Quinidine effect {Phases (0) & (3)}



— Ectopic Focus
 ---- Quinidine effect {Phase(4)}



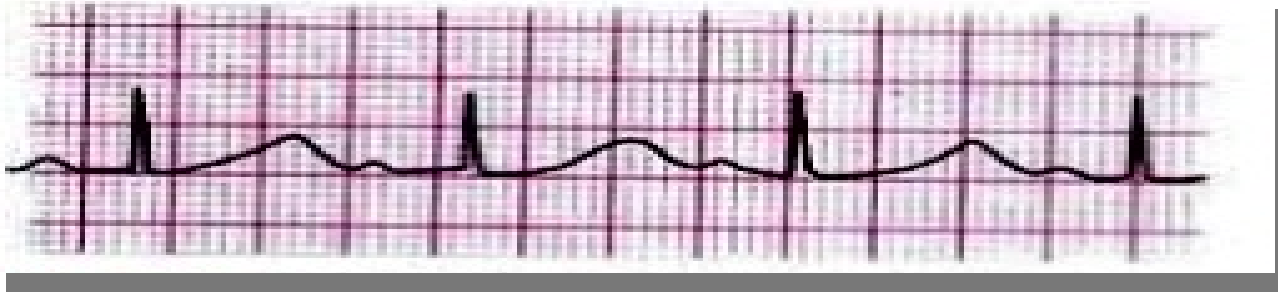
R-R interval - distance between 2 R-waves
R-R interval - distance between 2 R-waves



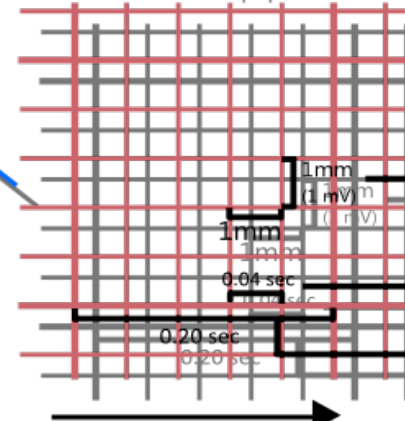
Bazett Formula

$$QT_c = \frac{QT}{\sqrt{RR}}$$

Normal QT_c interval ≤ 440 ms
Normal QT interval ≤ 440 ms
Prolonged QT_c interval > 500 ms
Prolonged QT interval > 500 ms



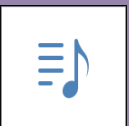
EKG paper
EKG paper



Each box is 1mm X 1mm
NOTE: One vertical box also represents 0.1 millivolt (mV) of voltage
One small box equals 0.04 seconds (40 millise)
One large box (5 small boxes) equals 0.2 seconds (200 millise)

Paper runs left-to-right as it traces the heart's electrical activity
Paper runs left-to-right as it traces the heart's electrical activity

- a- **Abnormal P-wave**
- b- **Long** P-R interval (specially in Large dose)
- c- **Long** Q-R-S = **Long Q-T**: If MORE than 25% = **Toxicity** → **Stop Quinidine**
- d- Abnormal T-wave

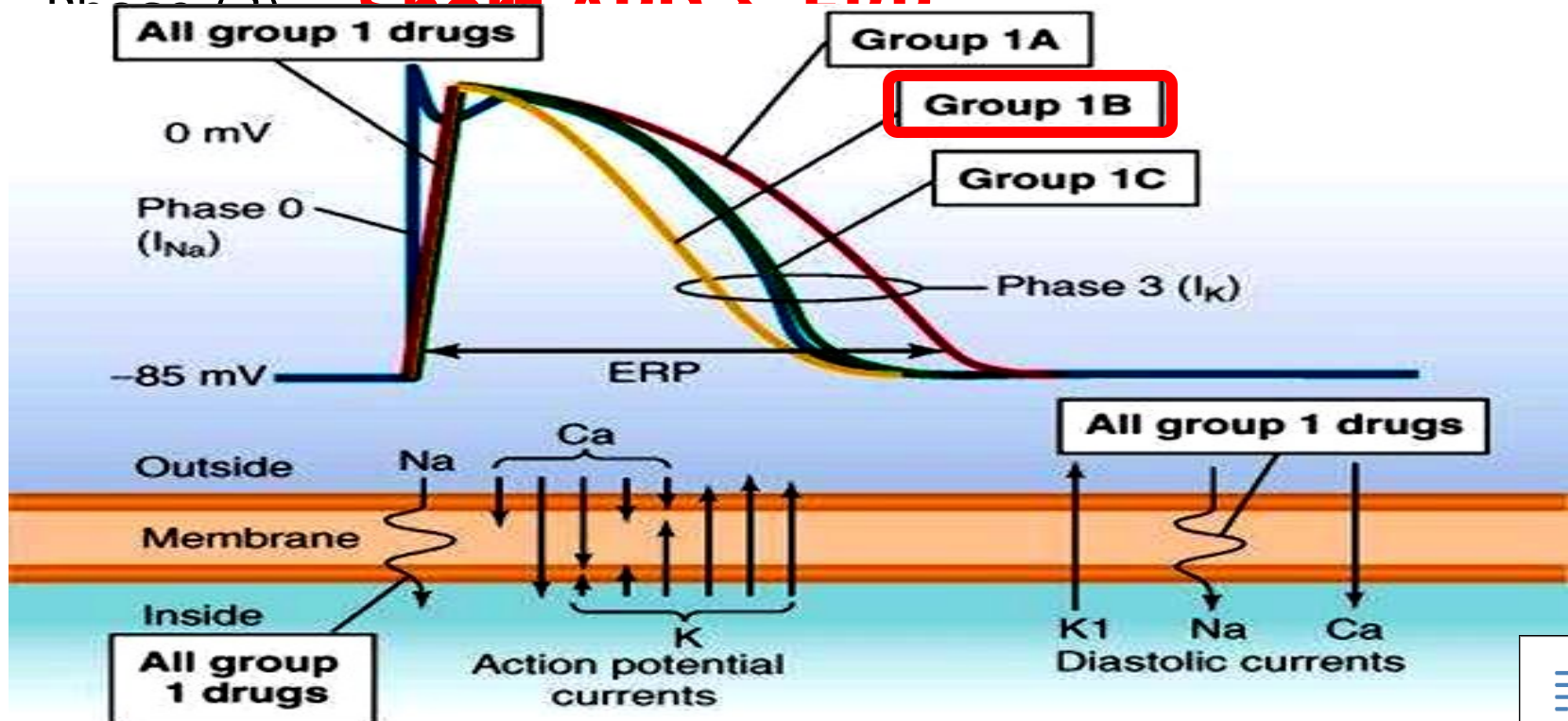


Lidocaine (Xylocaine , Lignocaine)

Class (I) **Group (B)** Anti-Arrhythmic

a- Blocks **Inactivated** Na^+ channel $\rightarrow$ Slow Phase (4) $\rightarrow$ **Slow Automaticity**

b- **Activates K^+ channel** $\rightarrow$ Rapid Repolarization $\rightarrow$ Short



Lidocaine (Xylocaine , Lignocaine)

- Therapeutic Uses → **Emergency**
Ventricular Arrhythmia with **OUT**
Heart Block

- a- Myocardial infarction
 - b- Cardio- surgery or catheter
 - c- General anesthesia
 - d- Digitalis induced arrhythmia
- N.B **Local Surface anesthetic.**



Lidocaine (Xylocaine , Lignocaine)

6- Undergoes **Extensive Hepatic Metabolism** → **Not effective Orally** & Short $t_{1/2} = 2 \text{ Hs}$

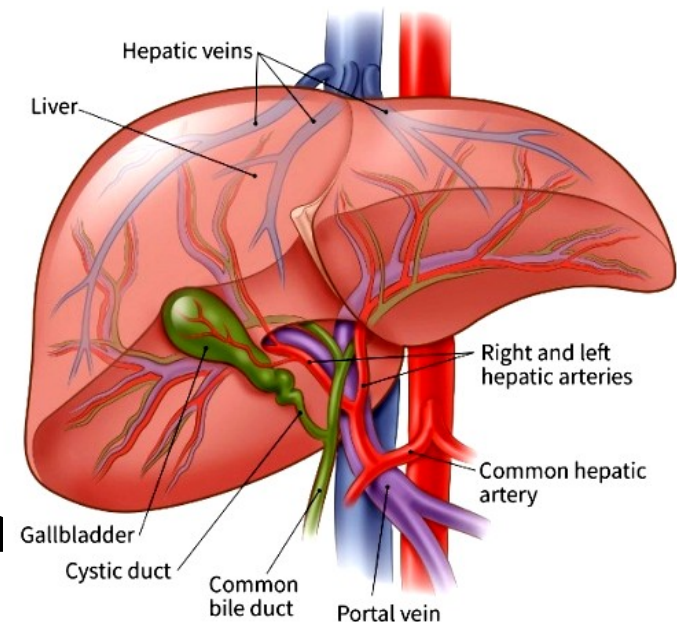
Decrease its dose in:

-Liver disease .

↓ Hepatic blood flow e.g.

.C.H.F. & β -Blockers

7- **Toxicity** → C.N.S. Stimulation
& Allergy



Propranolol

1- Class “II” Anti-Arrhythmic

Small Dose	✗	β -Adrenergic receptors ONLY	Class “II” activity
Large Dose	✗	<u>Na[±] channel</u> <u>Slow Ca²⁺ channels</u>	Class “I” Activity = Membrane stabilizer = Quinidine-like Class “IV” = activity

2

properties.



Propranolol

3- Therapeutic Uses As Anti-Arrhythmic:

a- **Sympathetic-induced arrhythmia** →
Use Small Dose of Propranolol

b- **Non-Sympathetic induced arrhythmia** → Use Large D

c- Particularly effective in

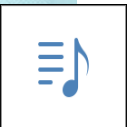


Supra-ventricular arrhythmia

**Propranolol → ↓ A-V conduction
→ Protects the ventricles**



Amiodarone (*Cordarone*)



Amiodarone (Cordarone)

1- Class “III” Anti-Arrhythmic → **Blocks K^+ channel**

→ Long phase (3) → → **Delay Repolarization**
Long A.P.D. & E.R.P. of whole



<u>Class “I”</u> <u>Activity</u>	Weak Na^+ channel blocker	Activated & Inactivated	Amiodarone has <u>ALL</u> <u>Classes</u> <u>activity</u> I, II, III (K^+) & IV
<u>Class “II”</u> <u>Activity</u>	Weak α & β - blocker	Non- competitive	
<u>Class “IV”</u> <u>Activity</u>	Weak Ca^{2+} channel blocker		

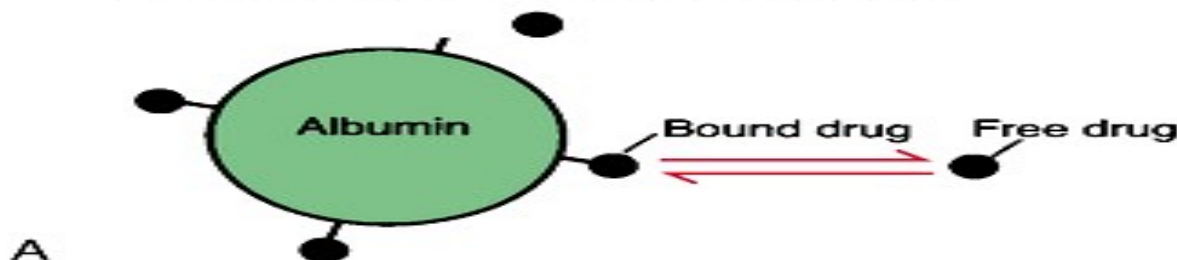


Amiodarone (*Cordarone*)

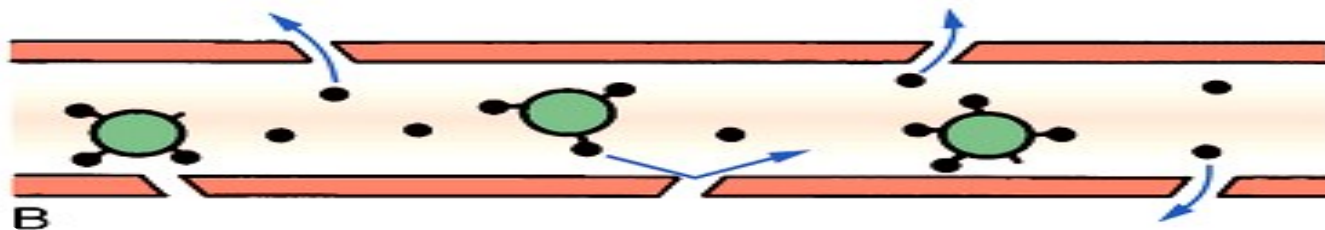
Pharmacokinetics:

- a- Absorbed orally
- b- **Extensively bound to plasma proteins**

Reversible Binding of a Drug to Albumin



Retention of Protein-Bound Drug Within the Vasculature



c- Slowly metabolized → Very Long $t_{1/2}$

25 - 60 days



Amiodarone (*Cordarone*)

7- Therapeutic Uses:

a- **Supraventricular** & **Ventricular arrhythmias.**

b- **Angina pectoris** → Coronary V.D.,
↓ Cardiac work & ↓ O₂ needs.



Amiodarone (*Cordarone*)

8- Adverse Effects:

- a- C.N.S.: Headache, paresthesia, tremors & ataxia
- b- Corneal deposits.
- c- Skin deposits □ **Photodermatitis.**
- d- **Thyroid dysfunction** (Amiodarone contains iodine).
- e- **Pulmonary inflammation & fibrosis → May be fatal.**
- f- **C.V.S.: Bradycardia, heart block, heart failure & hypotension.**
- g- **Hepatic injury.**
- i- Constipation.
- j- Drug interaction □ □ Renal clearance of Digoxin, Quinidine, Warfarin & Theophylline.



Verapamil & Diltiazem

- 1- **Class "IV"** Anti-arrhythmics → Block Voltage-dependent **L-types of Ca^{2+} channel**:
- a- Slow **Automaticity** of Ectopic focus.
- b- ↓ S.A.N. & ↓ A.V.N. **conductivity** & **Excitability**.
- c- **Short phase (2)** in muscle fibers.



Verapamil & Diltiazem

2- Therapeutic uses:

a- **Supraventricular Arrhythmias:**

- Verapamil 5 mg Slow I.V. over 2-5 minutes is the **Choice** in treatment of P.A.T.

- It treats the arrhythmia + ↓ A-V conduction → **Protect the ventricle**

b- **Ventricular arrhythmia with OUT Heart Block.**



Miscellaneous Antiarrhythmic Drugs

1- Treatment of the **cause** e.g. Hyperthyroidism.

2- **Sedatives & tranquilizers.**

Adenosine: IV in **paroxysmal supraventricular -1 tachycardia** as it slows A-V conduction

Digoxin: supraventricular [atrial] arrhythmias **-2**

Magnesium: arrhythmias due to **hypomagnesemia -3**

5- **Magnesium chloride:** Ventricular fibrillation & **Digoxin** toxicity

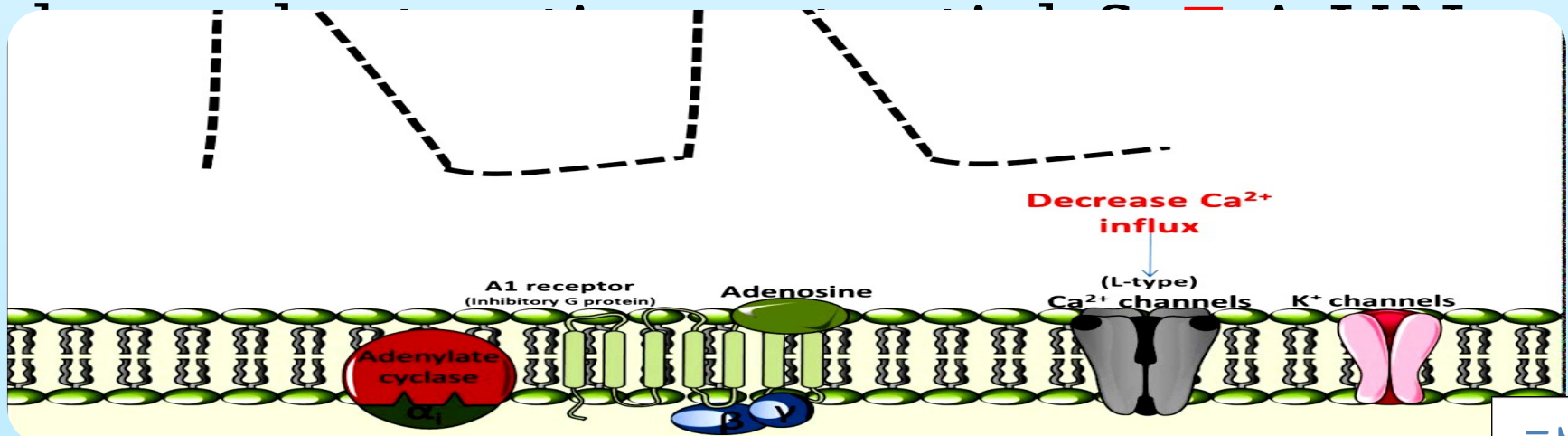
6- **Calcium chloride:** Ventricular tachycardia due to **hyperkalemia.**



Adenosine

■ Actions:

- a- **Stimulates A_1 -R** □ Open K^+ channel & □ cAMP-induced Ca^{2+} influx □ **Hyperpolarization** & □ Ca^{2+}



Adenosine

▪ Actions:

b- Very short duration of a

.c- 6 mg I.V. bolus in **P.A.T**



Adenosine

▪ Adverse effects:

- Headache, Flush.
- Hypotension.
- Hearth block .
- **Bronchospasm.**

Adenosine
Asthma

▪ Interactions:

Antagonized by *Theophylline* (**A₁-R blocker**).

Potentiated by *Dipyridamol*

(☐ **Uptake of adenosine**)



**THANK
YOU**